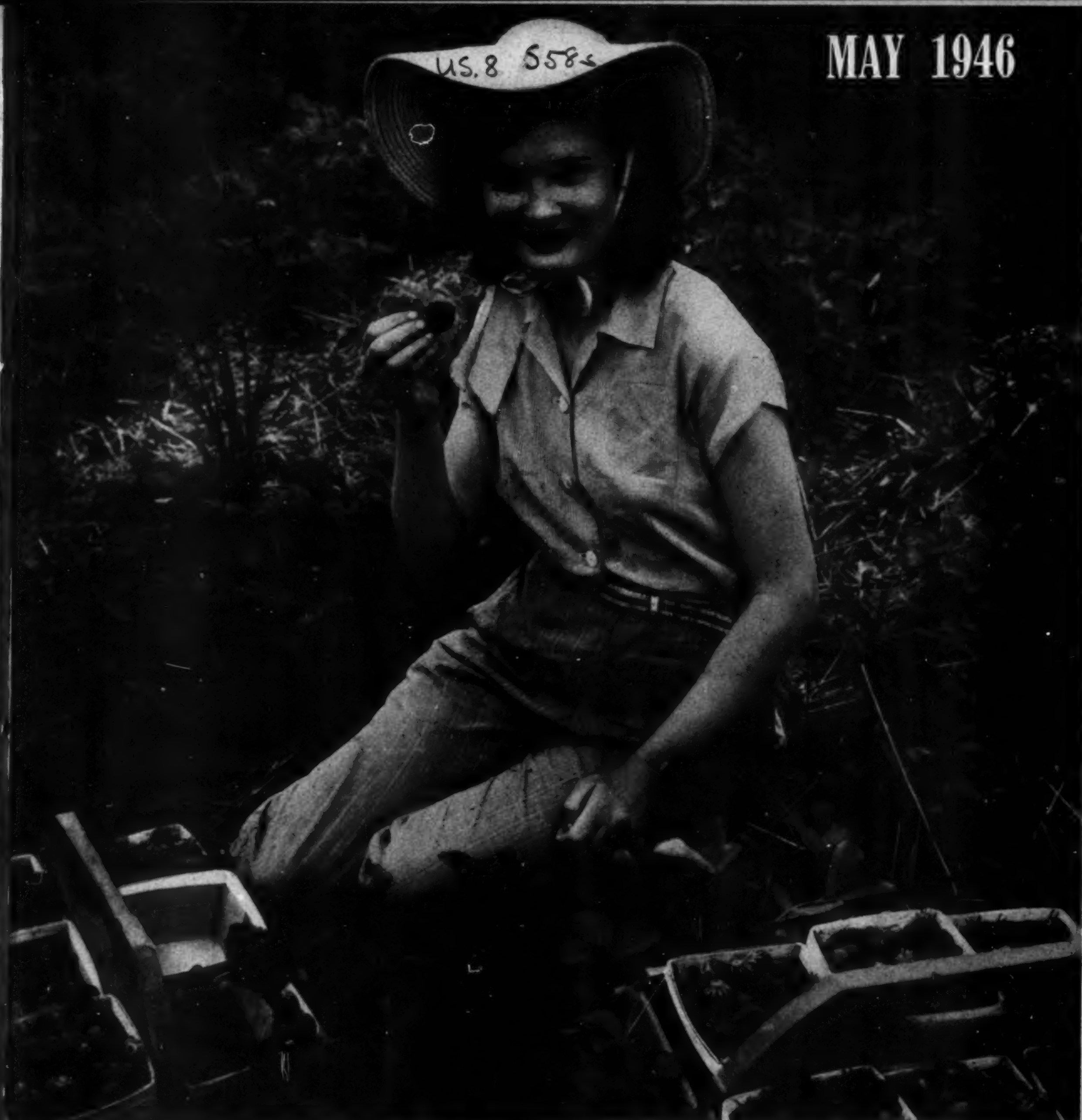
MAY 1946



SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

NITED STATES DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

SOIL CONSERVATION

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WELLINGTON BRINK, EDITOR

CONTENTS

Front Cover: Home gardens profit from soil conservation measures. Cultivation across the slope, mulching, and other standard erosion-control practices are being ever more widely adopted for growing vegetables, berries, and other crops for the home table. The photograph introducing this issue was made by George Pace. The smiling young lady is Miss Betty Sue Medlin of RFD 4, Milan, Tenn.

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South Starts on Long Road Back

The Honorable Sam H. Jones.

By the Honorable Sam H. Jones former Governor of Louisiana

THROUGH the conservation of soil, water and forest, the South is returning to agricultural and economic stability and prosperity. The road back will be long and slow. But the start has been made, and with everyone contributing his needed help, restoration of the South to its once traditional place of agricultural, financial, and cultural eminence is assured.

Among the many things I learned as governor of Louisiana was this fundamental: that country is rich whose people do the most with its land, its water, and its forests. All else depends on that.

Despite our obvious dependence on the land for our very existence, this Nation as a whole is seeing its soil material washed and blown away through erosion at the rate of 3 billion dollars a year. At least 500 million dollars in soil is being washed from the States of the South into the Gulf of Mexico each year. Never in the history of any country in the world has erosion been so swift and destructive as in the United States. We are headed for disaster and poverty unless we stop this wanton waste. We shall go the way of all great civilizations if our present course is not changed and changed soon. Until very recently, our course was one of economic suicide. Remember that the loss of agricultural land in one way or another preceded the decline and fall of each civilization the world has known.

This actual situation makes soil erosion one of the most serious of America's problems. Some responsible people have gone so far as to call it the most serious problem of them all. It all sounds at first like a prophesy of certain doom. Those who have studied the problem, however, know that land can be saved if we start in time. It requires work and determination. The Soil Conservation Service lists a total of 59 standard conservation practices for the job. These practices are interlocking safeguards, one supporting another. All are seldom used at one time. Various combinations are fitted together to suit the needs and adaptabilities of particular lands. This is what is known as a coordinated program of soil protection. All of the various conservation practices are based on the principle that we must cooperate with nature. If we oppose nature, we shall lose the fight.

We in Louisiana are richly blessed if we would but take advantage of our natural resources and our opportunities.

Our land is abundant in farm requirements. Our farms comprise 9 million acres of land poten-

(Above)

This eroded land in Louisiana's West Feliciana Parish was too steep for safe production of tilled crops. It was taken out of cultivation and seeded to a mixture of clovers, Dallis grass, and Bermuda grass.

The same field after having been treated with lime and commercial fertilizer, and seeded to clover and grasses. The vegetative cover resulting not only holds the soil against washing but also adds weight to beef cattle and increases milk production of dairy herds.

(Below)

tially as productive as any on the face of the earth. Yet less than half of this particular land is in cultivation and, before the war, Louisiana farmers averaged but $186 a year in cash.

We have the most ample rainfall and the most extensive waterways of any State in the Union. Yet we let our streams become clogged with shallows and shoals that block navigation. We let water remain on our rich farm acres, where it damages crops every year to the extent of 25 million dollars. Our failure to practice proper soil conservation deprives us of a farm income five

No help to the community is this chewed-up slope. But there are ways to mend such land, even make it profitable. Tree-planting, for instance.

times that of 1940. While the Federal Government wisely spends millions of dollars to irrigate western desert lands, we do nothing in asking aid for removing excess water from the five million-odd Louisiana acres that need drainage badly and, if drained, would be exceptionally fertile and productive.

Unplanned and unwise exploitation of our resources in the past led relentlessly to the depletion and impoverishment from which we are now beginning to emerge through the adoption of conservation practices.

We had an immense acreage of forest lands, of virgin pine and hardwood. We let outside exploiters have this wealth for a song. We sat idly by and saw some of the Nation's finest forests cut to the ground, with no thought of the waste or the

Average age of these trees is 30 years. This fine woodland belongs to S. W. Taylor, a district cooperator near Farmerville, in Union Parish. Selective cutting has just been completed with the aid of technicians of the Soil Conservation Service. Some logs were removed first, followed by pulpwood operations.

These pine trees were planted on a badly eroded hillside in 1940, with the help of the Soil Conservation Service.

depletion that was bound to follow when the rains, finally unchecked, tore through the earth and washed away the soil. We saw our lands ruthlessly stripped, our future cut out from under us.

Eventually we saw crumbling, rotting ghost towns which once thrived on prosperity. With destruction of our forests went jobs and income for our people. Came the breadlines, the doles, and the makeshift jobs.

Thus have we ignored the richness of our soil, disregarded our highly valuable water supply and permitted the destruction of our forests in the most reckless manner known to mankind. It is enough to cause us to hang our heads in shame.

What has this unplanned, this thoughtless, this extravagant, this reckless, exploitation of our resources reaped for our people? In the winter of 1940–41 there were half a million persons in Louisiana too poor to provide the next meal. One out of every five persons in the State was being fed at public expense. And at least half of these came from farm lands that are potentially the most productive on earth.

Looking around me, I found our soils eroded, our forests gone, our waters drenching and ruining our crops and a fifth of our people on the verge of starvation in what should have been a land of plenty.

Short-sighted policies were being followed on our farms. Thirty percent of our farms had no milch cows, 27 percent had no hogs, 16 percent had no gardens, and 11 percent had no chickens. I found that every year we were importing 50 million dollars worth of livestock products that could be produced in Louisiana. We were importing 7 million dollars worth of poultry products that could be produced here. Our farmers were actually buying millions of dollars worth of feed that they could raise on their own farms. And they were using farming methods 25 years behind the progressive practices of the better farm sections.

I looked about me in the Southland and found that Louisiana was no exception to the rule: the entire South was following the same unplanned, short-sighted, extravagant, wasteful policies, policies that were relentlessly leading our people to illiteracy, malnutrition, poverty, and desperation.

No less than 2½ million homes were classed as substandard and unfit for human habitation in a civilized country. I found the most eroded soils in the Nation, the greatest illiteracy, the poorest housing, and the most disgraceful health record.

I found the poorest farming. The average income of the South's people as a whole was $25.50 per capita a month, the cash income of our owner farmers, $15.50 a month, of our tenant farmers, $6.25 a month.

I found a woeful failure to look at the fundamentals involved—the fundamentals of soil and water and forests. No thought was being given to the building of wealth-producing farms, despite the fact that farmers constitute the largest part of our population in Louisiana. The prosperity of the State depends directly on the welfare and prosperity of our farm people.

Yes, the Southland was depleted and discouraged. Not always had it been that way. Once, not so long ago, it was the richest portion of the Nation. It once had 49 percent of the Nation's wealth whereas today it has but 10 percent. Louisiana was once the richest State in the Union. Its people had incomes 72 percent greater than those of New York State; today they have about half the national average. The port of New Orleans once handled more cargo than the entire British Empire; today it handles about 12 percent as much as the port of New York. Louisiana was once the banking capital of America; today it cannot boast of even a Federal Reserve bank. Seven-eighths of America's millionaires once made their fortunes from Louisiana's farm lands; today the total annual per farm income, in cash and home-consumed commodities, scarcely exceeds $500.

Yes, the Lord bestowed His bountiful blessings upon us. He gave us rich soil, ample rainfall, and millions of acres of beautiful forests abundant with wealth. But I am afraid that we have been like the servant who took the talent from the Lord and hid it in the earth. We have not conserved our resources to produce more and continuing wealth; rather we have been destroying the resources which produce our wealth.

Our mission should be to point a new way; to convince our people that there is a way to help the poor and the destitute without resorting to the dole and the poor house; to build new hope in the hearts of the underprivileged, new ambition where ambition has vanished; to point out vast remaining wealth on which to build; to clear a pathway over which our people can once again advance to a prosperous life; to help people help themselves; to bring back equality of opportunity.

To help attain this goal, we should plan to put into cultivation at least an additional 4 million rich acres and thus take care of 25,000 additional farmers on a profitable standard. We should remind our people that a forest industry now yield-

ing 125 million dollars a year could be doubled and provide jobs for 20,000 more persons. We should remind them of the new discoveries that expand the markets for our forest products. We should give them a picture of the tung oil industry and what it can mean to this Gulf coast area.

We should plan the drainage of our rich farm lands that have an excess of water, thus averting crop damage of 25 million dollars annually while multiplying by five our total farm income.

True, progress is slow. But more people are beginning to think about these things. Today we have our economic development committees which view the future with a broad agricultural, industrial, financial, and even cultural perspective. Today more people are talking about better farming, finer livestock, conservation of our soil and other resources, building greater waterways, and providing greater drainage programs. We have begun to look around for those whose job it is to conserve our forests and other resources, to save our soil and thus build a richer agriculture, to provide a livestock industry and to bring health, happiness, and prosperity to our people.

We are getting down to fundamentals. We are getting back to the soil—to the soil which has meant and can again mean so much in material prosperity to our people. Action at last is following years of preaching about the right kind of farming, the balanced kind, the diversified kind that provides sustenance whether or not one money crop happens to fail.

We have called upon science and research to help us with the job. We are quitting ruinous practices and are beginning to conserve our soil. We are departing from primitive methods and beginning to substitute modern, tested practices and to use efficient, money-saving mechanical equipment. More and more we are turning to industrial and agricultural research to help us solve our farm problems and give our farm families higher incomes, greater purchasing power and better living standards which elevate the economic welfare of the entire community, State, and Nation. What affects the farm segment of our country affects the entire population. We know that everyone, farmer, banker, business man, industrialist, and just plain citizen, has a stake in the restoration of our land to a sound, lasting, and profitable basis of productivity.

We in Louisiana are tackling the problem in the field. Already we have the most complete soil conservation set-up in the Nation. We are wiping out our deficiencies in livestock. In spite of reduced manpower, the 1944 farm income was twice that of 1940.

True, we are still spending millions of dollars out of the State for meat, dairy products, and poultry. But we have made a start and I believe we are tackling the job constructively and intelligently. To build a great livestock industry we need a pasture program. To have good pastures we need additions of lime, potash, and phosphate to our soil. Within our borders we have great supplies of lime in both stone and shell. Yet until recently we did not utilize this resource. In 1941 we had no agricultural lime plants and we placed only 10,000 tons of lime on all Louisiana farms. In 1944 we had 3 lime plants in operation and placed 300,000 tons of lime on our farms and pastures, an increase 30 times over in 3 years.

We need 3 million acres of improved pastures as against the 1 million semi-improved now in existence. Our job of pasture improvement has just begun.

It is well to remember at the beginning of our task that none of our goals can be reached without conservation of the soil itself. That means not only the control of erosion but careful planning to use our soils for the purpose they are best suited by nature. It means the efficient use of water. It means a planned rotation in order to get the largest possible yields per acre, to get crops of higher quality, and to prevent deterioration of the soil by year-after-year planting of the same soil-depleting crop.

Soil conservation embodies a complete and coordinated program designed to utilize every acre of the farm productively. We have dedicated ourselves to this task in the accomplishment of which the Soil Conservation Service is making an outstanding contribution.

Louisiana has approximately 29 million acres of agricultural land, of which some 25 million acres are now included in soil conservation districts authorized by State law. Twenty-two of these districts have been organized so far. In the creation of soil conservation districts our farmers are not only saving the soil and making it more productive but they are keeping alive and proving the value of democratic government. Soil conservation districts are organized and governed by the farmers themselves. Thus is the principle of local self-government perpetuated.

Louisiana has 5 million acres of productive, fertile land in need of drainage. Thousands of dollars in labor, seed, and fertilizer are drowned out each year. This 75-acre field lost two corn plantings by flooding.

It should be kept in mind that the mere placing of our entire 29 million farm acres within soil conservation districts will not in itself do the job. Under a coordinated, over-all plan of soil conservation, we must take the 9 million acres that compose our farms and do the necessary terracing, contour plowing, and strip cropping that will stop erosion. We must take our vast areas of cut-over land and stop erosion by building pastures and new forests. We must take the five million-odd acres that need drainage badly and put those acres into fruitful production. We must replenish the fertility of the soil by putting back into the earth minerals that the plant life has used. In short, we must cooperate fully with nature.

Until we do all of these things, our job of soil conservation will not be ended. As I have indicated, in Louisiana we are just beginning the huge task of restoring our soils and insuring them against future loss by erosion. A good foundation has been laid and we have a capable staff of administrators and technicians. But the big job remains to be done.

While it is comforting to know that 87 percent of the state agricultural area is embraced in soil conservation districts, the fact remains that only 9,300 farms out of the 150,000 in the State have as yet signed agreements to install coordinated soil conservation programs. We still have about 140,000 farmers to enroll. And they must be enrolled if we are to conserve our soil and build a permanently prosperous Louisiana.

Planning for lasting agricultural prosperity must include a farm balance of food, feed, and fertility crops. We must get back to the philosophy of producing a living on the farm. We must raise food for the family and feed for our livestock. And we must plant crops which will restore the fertility we have taken from the soil. We must balance our crops with livestock in a proportion consistant with sound land use. We must not only preach but we must put into practice the doctrine that the cow, the sow, and the hen are still the keystones of agricultural prosperity. We must balance our agriculture with industrial development.

This is the same field after installation of a drainage system. This ditch takes care of excess water from 190 acres of fertile land. It was designed cooperatively by district and Soil Conservation Service.

It has been proved time and again that a coordinated conservation program not only saves the soil but increases per-acre yields and improves the quality of crops. Knowing this, I can't believe that we lack the intelligence, the vision, the wisdom, the energy, and the ability to do the things necessary to restore our agricultural productivity and prosperity.

I see a future of new forests to grow new wealth and protect our soil. I see luxuriant pastures that will sustain five times the cattle population we have today. I see scientific farming practices that will give us a diversified program and a farm income that will reach a half billion dollars a year in contrast with the 100 million dollars annual income before the war. I see a State that will solve its drainage problem and add 25,000 new farms of 160 acres each. I see the utilization of machinery and modern farm mechanization that will take away the drudgery and permit us to compete with the most prosperous farm sections of America. And I see in our farmers the pioneers who are blazing a new trail, the pathway to future prosperity and happiness, for through their initia-

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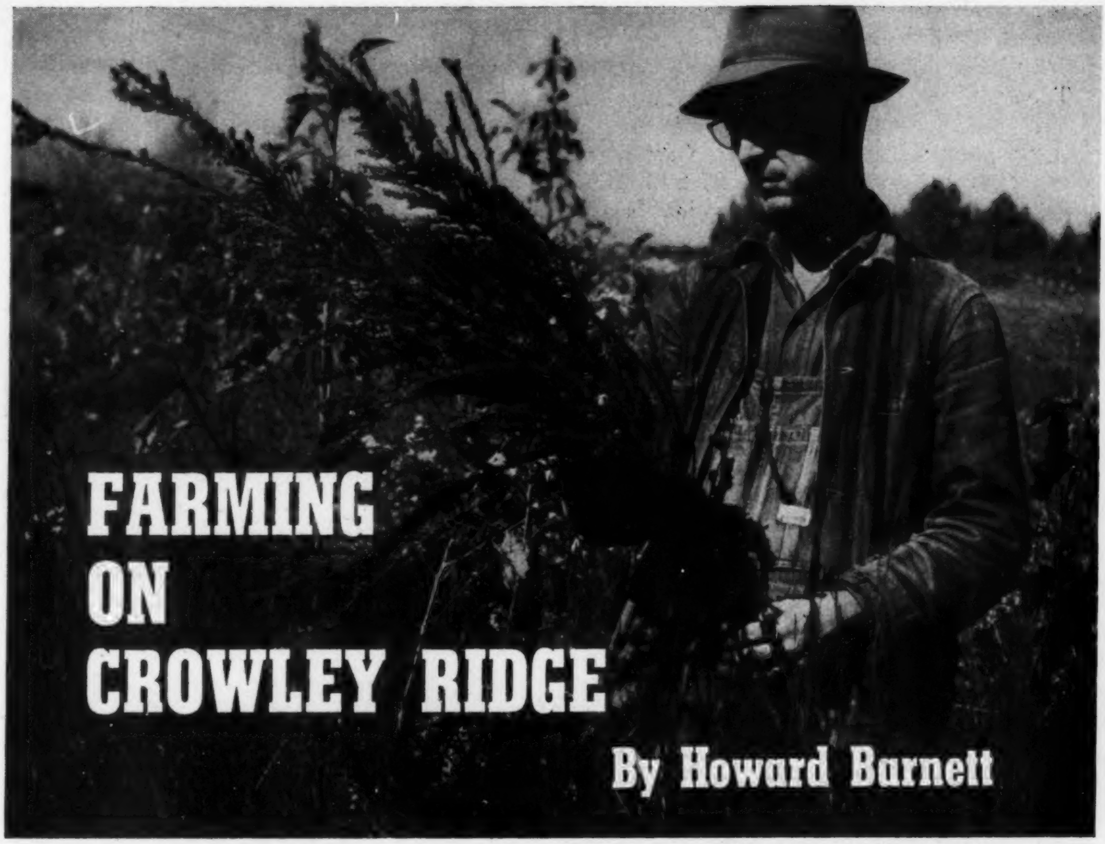


FARMING ON CROWLEY RIDGE

By Howard Barnett

Adamson's pet gully-healer is sericea lespedeza. At one place where he seeded sericea and little bluestem an old gully has filled two feet in the last six to eight years.

LUTHER Adamson, who farms 174 acres a few miles north of Forrest City, Ark., on Crowley Ridge, cut and sold considerable timber from a sizable hollow on his place last fall. Exactly where that hollow is located—on the same ground where he cut the trees—Adamson harvested a pretty good crop of sweet potatoes back in 1916.

There wasn't a tree in the immediate vicinity of the yams in 1916. Neither was there a hollow. The sweet potato field, at that time, was a productive piece of gently sloping land.

Adamson moved away from the place that year. He didn't come back until 1934. During the 18 years he was gone the hollow developed. The sandy, sloping soils of the sweet potato field eroded away.

"Don't suppose it ever had a terrace or a contour furrow on it," says Adamson. "I'm sure it didn't have any soil-improving crop.

"I know what happened. The field was new land when I lived here before. The soils stayed in place, fairly well until several years of crops depleted the fertility. Probably there was considerable sheet washing. Then a gully started. Nothing was done about it. That's fatal on these loess soils. It couldn't have taken long for the gully to wash out until it became this hollow. Now I could put my whole house and two or three more in there.

"The trees came in—mostly these hardwoods—and this year some of them were big enough to cut. The soil in the hollow is rich—all this loess soil we have here is just topsoil picked up somewhere in ages past and laid down here. This year's is the first production from that land for probably 25 years, except for a little firewood now and then."

Adamson doesn't want any more tree-growing hollows developing where the land is suitable for cultivation. For that reason, he's particularly careful with cotton and corn.

NOTE.—The author is district conservationist, Soil Conservation Service, Forest City, Ark.

"The way I see it," he says, "the average farmer wears his cotton land out before he rests it. Then he has trouble bringing it back to good yields."

To win in the touch-and-go battle with erosion on cropland, Adamson uses a variety of conservation practices. He is a cooperator of the South Crowley Ridge Soil Conservation District. Frequently he consults Soil Conservation Service technicians assigned to the district on the right way to solve some particular problem. One of the chief measures Adamson uses is to plant plenty of soil-improving crops. He has one pasture which has been in lespedeza and winter rye grass for seven consecutive years.

"It's ready for a crop or two of cotton now," Adamson says. "The fertility is up, but it won't be there long if I don't keep on using soil-improving crops, necessary terraces, and outlets."

Adamson's crop-rotation plan calls for cultivation 2 or 3 years and then pasture for 6 or 7 years. It pays off. Following that system, and using winter cover crops of bur clover and hairy vetch while the fields are in cultivation is part of the rotation. Adamson has raised his lint cotton production from half a bale to the acre in 1934 to 505 pounds per acre now.

Bird dog in pasture. Dallis grass and common lespedeza make good grazing for Adamson's cattle and a fine habitat for quail.

These logs have reached maturity since 1916. They came from a field that once grew sweetpotatoes.

The cultivated crops don't draw all the benefits of the rotation, either. Dallis grass and lespedeza for the eighth straight year on one field produced a ton of hay to the acre in 1945—well above the average for the neighborhood.

Adamson uses soy beans with his corn. "I make all the way from 20 to 60 bushels of corn per acre, depending on how good the soil is. Where corn is grown without a conservation rotation it makes 10 to 15 bushels around here."

The 174-acre farm runs 29 head of cattle, 5 head of stock, 125 chickens, and from 25 to 90 hogs annually. The pasture and feed grown on the place provide enough for the animals to eat, although Adamson supplements the cattle ration in winter with some protein, usually cottonseed meal.

Farming on Crowley Ridge, which soils men say is a formation of hills laid down by winds carrying particles of soil, calls for a continuing fight to stand off the erosion that threatens constantly.

Run-off water from Adamson's road washed out a ditch in an adjoining field. It was so large that a tractor couldn't cross it. Adamson sloped the sides of the gully and seeded sericea and little bluestem. The gully has filled in more than 2 feet in less than a dozen years and the erosion is controlled.

Adamson seeds and sods whenever he sees a gully start. He has a favorite gully preventive measure, too. It consists of leaving border strips 30 feet wide between his cultivated fields and the impinging woods or roads. "You don't make anything out of that area half the time anyway," asserts Adamson. "It's worth a lot to me to have the quail that border strips bring in. The strips grow up in native grasses and I let my cattle graze them in winter. They're good forage."

Adamson has built over 10,000 feet of terraces. All his cultivation is on the contour. He regulates grazing on his pastures, temporary or permanent, to help the grasses reach their maximum growth. Crop-residue management, liming and fertilizing where needed, and spreading barnyard manure are among other conservation measures which he follows profitably.

"I farm the conservation way, because it builds up the land. It helps me make a better living. I began bending my rows before the soil-conservation districts came along. We had done that back in Mississippi when I was a boy. But contour rows and terraces aren't enough. A lot of mud still leaves in run-off water after a rain. Not as much as when I came back here in 1934, but too much. That mud is topsoil. Conservation farming is helping me stop the washing. It's helping me have a farm that will still be producing years from now. This farm might have been gone now if I hadn't been doing things to take care of it."

LONG ROAD BACK

(Continued from page 248)

This cultivated field has been terraced so that the water empties into a sodded ditch, which also serves as a parish road ditch. Water so handled causes a minimum of erosion damage.

tive in organizing and governing soil conservation districts they are leading the Nation to a sound and permanent agricultural economy.

We have a herculean job to do. We have begun that job. To attain our goal we must have education and work and vision and money. We have our minds set to it and we will succeed. Success means the rebuilding of our worn-out farms; the development of luxuriant pastures; greater yields of old and new crops of finer quality; better beef and dairy cattle; more modern, comfortable, and attractive homes; greater income for the small farmer; a higher standard of living with more of modern conveniences to banish drudgery; greater purchasing power and hence more business for the business man and a fuller, more pleasant life for the entire community.

With this will come a healthier people; brighter looks on the faces of our farm boys and girls; better nutrition; better education; better opportunities. Better roads will be built to our farms because we'll have more money to build them. There will be better churches and better schools. Electric lines will lead to all our farms instead of merely one-fifth as at present. Labor-saving machinery will help the farmer as electrical appliances will help the farm women. There will be less drudgery and more time for the religious, civic, and cultural side of life.

It will mean a new day for Louisiana, a new day for the South. It is not merely a dream. It is a practical, time-tested plan that is based on the soundest of fundamentals—the conservation of our soil, our water and our forests.

Average size of a farm in the United States is 174 acres. But don't be fooled by measurements—it is productive capacity that counts. Soil conservation makes every acre bigger.

EARTHWORMS FIGHT EROSION, TOO

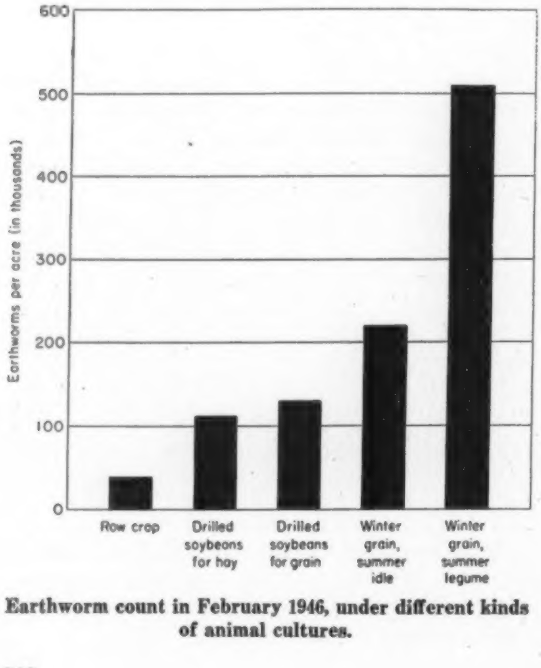
BY HENRY HOPP

NOTE.—Joint credit for the studies here described goes to Homer T. Hopkins, Jr. He and Mr. Hopp are soil conservationists with the Soil Conservation Service, Beltsville, Md.

THE LOWLY earthworm's part in conserving soil is being studied by research workers of the Soil Conservation Service.

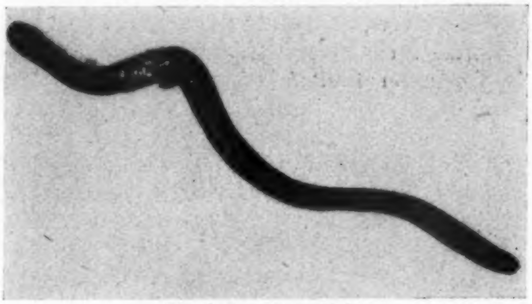
Soils experts have long known that the formation of granules helps to make the soil resistant to erosion. These granules are known technically as soil aggregates. Aggregates consist of individual soil particles cemented together into larger pellets.

The individual particles of a soil are classified as gravel, sand, silt, and clay. Gravel is made up of particles larger than approximately 1/25 of an inch. Sand particles range from 1/25 of an inch down to 1/500 of an inch. Silt particles measure between 1/500 and 1/12,500 of an inch. Particles smaller than 1/12,500 of an inch classify as clay.



Earthworm count in February 1946, under different kinds of animal cultures.

In an unaggregated soil the particles are separate. When exposed to the erosive action of rain and flowing water, many tiny particles are carried away and the rest are packed together. Soil in this condition becomes waterlogged with rain; crusted and hard with drought. When a soil becomes aggregated, the individual particles—usually the smaller ones—join together into larger compact granules. These granules may vary in size up to 1/4 of an inch thick. They resist better the beating action of rain, and because they are not carried so easily by flowing water make the soil more resistant to erosion. Well aggregated soil keeps its looseness when dry or wet. Water goes in easily and the soil remains ventilated. This good balance between air and water in the soil helps plants to grow. The formation of aggregates, therefore, becomes a matter of prime importance to soil conservation.



Lumbricus terrestris.

We know that microscopic soil organisms have a part in forming aggregates. The bacteria and molds of the soil live on dead vegetation or the trash left after crops are removed. Certain of the bacteria are known to produce slimy materials capable of cementing individual particles together. Molds consist of fine threads which may serve similarly.

Now, data from the new project seem to show that earthworms are topnotch builders of aggregates.

In one test, soil from a lespedeza field was first screened. The screen had holes 1/50 of an inch in diameter. This fine soil was placed in containers and water was added. One container held the soil plus whatever bacteria and molds were naturally present. The contents of the other con-

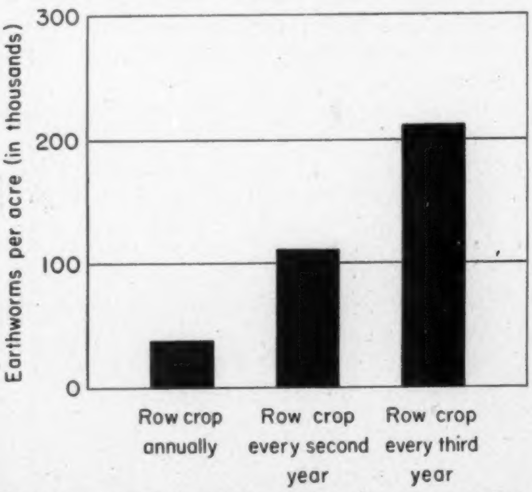
tainer were similar except that worms were added.

After 3 days, water-stable aggregates had been formed that would no longer pass through the screen. In the soil containing microorganisms but no worms, 5.9 percent of the soil had formed these large aggregates. In the soil containing worms, 12 percent was in large aggregates. Thus, the soil containing worms had about double the quantity of water-stable aggregates.

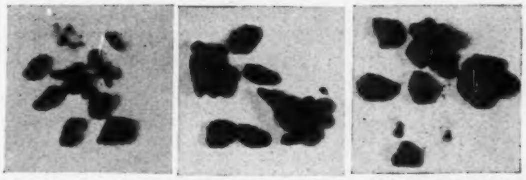
Not only was the *proportion* of aggregates larger with worms present, but the *durability* of these aggregates when hit by raindrops was greater. This was determined by subjecting the larger aggregates to water dropped from a height of 12 inches. The number of drops required to break the aggregates into their finer particles was counted. The aggregates formed under the action of microorganisms alone were broken apart by 6 drops, those from the worm cultures by an average of 13 drops. The worm-culture aggregates were, therefore, about twice as resistant to the erosive action of falling water.

Helodrilus caliginosus.

How do earthworms form these aggregates? Worms are unique in that they are among the few animals that eat soil. They eat the soil along with



Earthworm count in February 1946, after row cropping in 1945, in plots planted to row crops annually, every second year, and every third year.



Relative sizes of aggregates. Left to right: *Helodrilus foetidus, Helodrilus caliginosus, Lumbricus terrestris.*

organic matter. The excrement—or worm manure—is expelled as tiny pellets. These are the earthworm aggregates.

The rate at which earthworms excrete aggregates was determined in other tests. Three different kinds of earthworms were used: *Lumbricus terrestris*, which was obtained from a lespedeza field; *Helodrilus caliginosus* from a broomsedge field; and *Helodrilus foetidus* from a manure pile. They were given good moisture conditions, a fertile soil, and warm temperature. The rate of aggregate formation under these favorable conditions is shown in table 1. The *Lumbricus* worms, the largest of the three species, produced about their own weight of aggregates per day. The two other species, which were smaller, produced aggregates at a slower rate. The size and shape of the aggregates varied with the kind and size of the worms, the *Lubricus* worms averaging largest. It looks from these studies as if earthworms are pretty good aggregate factories.

Helodrilus foetidus.

To what extent can farmers increase earthworms in the soil by simple methods? Results from rotation plots started 5 years ago at the Maryland Agricultural Experiment Station offer some light on this question. One set of counts was made on land cropped the following ways:

(*a*) Row cropping every year.

(*b*) Two-year rotation (row crop the first season, small grain and sod crop the second season).

(*c*) Three-year rotation (row crop the first season, small grain the second season, hay crop the third season).

The earthworms were counted during the winter on the plots that had been in row crop the previous season. About 5 times as many worms were present in the 3-year rotation plots as in those subject to annual cultivation.

Table 1.—*Quantity and size of aggregates produced by earthworms in a culture of Christiana silt loam soil*

Species of earthworm	Average weight per earthworm (grams)	Quantity of soil aggregated per worm-day (grams)	Average diameter of aggregates (mm.)
Lumbricus terrestris	2.10	2.2	3.3
Helodrilus caliginosus	1.23	.5	2.4
Helodrilus foetidus	.49	.3	2.0

Table 2.—*Earthworm count in March 1946, under sericea lespedeza and broomsedge in alternate strips established in 1940*

Cover	Strip number	Earthworms per acre (thousands)
Sericea	1	1,100
	3	825
	5	915
	7	1,010
	9	1,830
Average		1,136
Broomsedge	2	320
	4	550
	6	550
	8	640
Average		515

Another set of comparisons suggests that farmers may be able to keep up the worm population even with an annual cropping system. The test included:

(*a*) Row crops, in which the land is plowed and cultivated.

(*b*) Drilled soybeans, in which the land is prepared by disking and no summer cultivation is given.

(*c*) Drilled winter grain, in which the land is prepared in the fall, and left idle after grain harvest in the spring.

(*d*) Drilled winter grain, in which the land is prepared in the fall, but a summer legume is seeded into the grain or after the grain is harvested in the spring.

The results for these counts revealed that the plots in the winter grain-summer legume cropping plan contained far the most worms, about 10 times as many as in the plots planted annually to row crops. Indeed, the worms in the winter grain-summer legume plots were almost as numerous as in legume sod plots. Good conservation use of the land and increased earthworm population would seem to go together.

A third study made by the earthworm project suggests the importance of growing legumes. An old broomsedge field on the Soil Conservation Service tract of the Agricultural Research Center at Beltsville, Md., had been partially converted to sericea lespedeza some 7 years ago. Five narrow strips, each 13 feet wide, were disked and seeded to sericea at that time, with intervening strips of the same width left in broomsedge. Earthworm counts made in early March of 1946 gave the results shown in table 2. More than 1 million earthworms per acre were found in the sericea strips, whereas, only half this number occurred in the broomsedge.

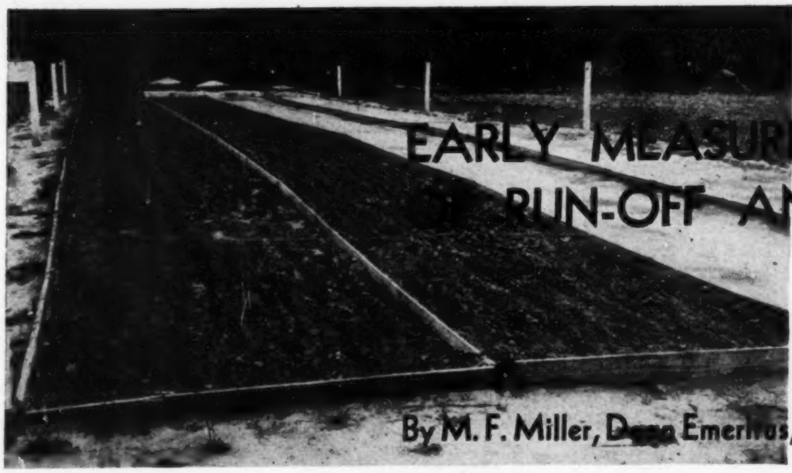
This project bids fair to add a new wrinkle to soil conservation. The studies indicate that an earthworm may produce, under good conditions, about 1 gram or thereabouts of aggregates per day. Worm populations of the size found in this study would be capable of aggregating perhaps 500 pounds or more per acre per day. So you see that the earthworm may be a real workhorse when it comes to turning out the aggregates we want for soil conservation. The earthworm project is begining to show that you can keep this workhorse busy and still use your land.

Wanted, a Pledge

To arouse all Americans to the realization of their duty to save and use wisely this country's vanishing soils and other natural resources, *Outdoor Life* is offering $5,000 in cash awards for a Conservation Pledge for use in schools and elsewhere. This pledge, 30 words or less, will be comparable to the Pledge of Allegiance to the Flag. First prize is $3,000. Each pledge must be accompanied by an essay of not more than 1,000 words on "Why America's Natural Resources Must Be Conserved." The competition ends July 31.

Member of the advisory board of distinguished leaders in conservation is Dr. Hugh Bennett, chief of the Soil Conservation Service.

"Leading conservationists warn that unless we take definite, practical measures to conserve our natural resources, we're in danger of becoming a nation in need," says Raymond J. Brown, editor of the sponsoring publication. "Every citizen should be made aware of this exigency and urged to do his part toward safeguarding our country's God-given treasures. Such is the aim of this competition."



EARLY MEASUREMENTS OF RUN-OFF AND EROSION

By M. F. Miller, Dean Emeritus, College of Agriculture, University of Missouri

The first plots laid out at the Missouri Experiment Station for preliminary trials in measuring run-off and erosion losses.

AT THE last annual meeting of Friends of the Land, in St. Louis, I was asked to tell something of the early work in measuring runoff and soil erosion losses at the Missouri Experiment Station. Since this brief talk created considerable interest, it seemed that it might be worth while to publish such a statement, largely for its historic value.

There seems to be little doubt that the first measurements of runoff and erosion losses from a field soil, under different cropping and cultural systems, were made at the Missouri station. Another early investigation by C. L. Forsling,[1] started in 1915, on two range areas in Utah, was designed to determine the influence of the intensity of grazing on runoff and erosion losses. These two investigations were inaugurated close to the same time but under quite different conditions, one dealing with cropped land and one with range land. The first report from the Missouri investigations appeared in 1923 and the first from the Utah investigations in 1931. However, before the detailed investigations at the Missouri station were inaugurated, certain preliminary trials were carried out and it is primarily with this preliminary work that this paper deals.

The first attempt to measure runoff and erosion losses at Columbia was inaugurated in 1915. A soils student, R. W. McClure, was assigned the special problem of measuring these losses from a small area of bare soil with a grade of approximately 4 percent. The plan was exceedingly simple. A curbing of 1-inch boards surrounding this area was set in the ground, with an opening at the lower side emptying into a small catchment basin. After each rain McClure dipped out the

Dean Miller.

[1] U. S. D. A. Technical Bulletin 220 (1931).

accumulated water and soil and determined the quantity of each. While the trial was continued for only about 2 months, during the latter part of the spring semester, the results proved very interesting. It was shown that such measurements could be made without great difficulty and it was, therefore, decided to carry the plan further as soon as opportunity offered.

The year following McClure's simple preliminary trial, a graduate student, R. W. Vifquain [2] was assigned a thesis problem dealing with water penetration, runoff, and evaporation, along with measurements of eroded soil. In this investigation the runoff and erosion measurements comprised the major part of the plan and proved the most interesting and most fruitful of results. Mr. Vifquain was a careful worker, well suited to this sort of work. The plan which was developed revolved around the influence of surface cultivation on water penetration and on water and soil losses. The purpose was to measure not only runoff and erosion but the depth of moisture penetration resulting from each rain. It was hoped also, through the penetration study, along with a study of water losses from a free water surface and from a lysimeter, to obtain data regarding evaporation losses from the soil. This attempt proved largely abortive.

The plan, as finally evolved, provided for four parallel strips (5½ by 91 feet) running up and down a slope having a grade of approximately 4 percent. The soil was Shelby loam, although it contained slightly more silt and somewhat less organic matter than is typical for this type. Each of the four strips or plots was surrounded by a curbing of 1-inch boards sunk into the soil with about 3 inches extending above the soil surface. The lower ends of the two inside strips emptied on a galvanized iron platform leading to a concrete catchment basin in which the water and soil accumulated. The two outside strips were left open at the lower ends and were used entirely for determining the depth of moisture penetration, after rains, by sampling to a depth of 4 feet.

One strip in each set was cultivated frequently with a hoe. The other strip was uncultivated but was kept free from weeds by carefully shaving the surface with a sharp hoe whenever necessary.

After each rain the depth of the water in the catchment basins was measured and cleared of suspended matter by the use of a flocculant. The water was then drawn off, and the soil removed, sampled, and the weight determined.

The measurements were continued through a period of 3½ months, May 1 to August 15, 1916. The results are recorded in the thesis filed by Mr. Vifquain for the A. M. degree in June 1917. They show the marked effect of cultivation, as compared with no cultivation, in causing an increase in the penetration of rainfall, as well as a marked curtailment in the amount of soil eroded. A summary of these results shows that the uncultivated soil lost through runoff, 47.9 percent of the total rainfall of 11.69 inches during the 3½ months period while the runoff from the cultivated soil was only 15.4 percent. Similarly, the soil loss from the uncultivated strip was 424.6 pounds while from the cultivated strip it was only 80.4 pounds.

These simple results are in general accord with those secured through later investigations at a number of the erosion experiment stations in the country. They are of interest as representing the first recorded field measurements of runoff and erosion and as providing a basis for the more extensive and long continued measurements at Missouri and at the erosion experiment stations.

Great credit should be given Mr. Vifquain for his careful work in this first attempt to measure water and soil losses from cropped lands. He was the pioneer worker in this important field which has been extended so greatly during the last 25 years.

The year following Mr. Vifquain's work (1917) a regular experiment station project was inaugurated, the results of which have been widely used. The installation of these plots was on the same site as that used by Mr. Vifquain. The detailed plans for this project were largely developed by F. L. Duley,[3] who was in charge of the operations on the project until 1925 when he left the University of Missouri to join the staff of the Kansas State College. Great credit must be given him for his careful planning and execution of the work during this period. Following Dr. Duley's departure the details of the experimental work were taken over by H. H. Krusekopf [4] who had charge during the latter part of this period of measurements and to whom much credit should be given.

It should be understood that the results of such

[2] Now director of short courses and personnel officer, Division of Agriculture, Iowa State College.

[3] Now with the research division of the Soil Conservation Service, and stationed at the University of Nebraska, where some very important cooperative work is under way.

[4] Professor of soils, University of Missouri.

measurements have their limitations, particularly when applied to ordinary field practices. They usually represent data from only a segment of a longer slope. Their principal value has been that of showing the very wide comparative differences in runoff and erosion losses from land in different crops, rotations, sods, or different types of cultivation. For instance, the Missouri data showed that the annual loss per acre of soil from uncropped, cultivated land was 41 tons, from continuous corn 19.7 tons, from continuous wheat 10.1 tons, from a 3-year crop rotation 2.7 tons, and from continuous blue-grass sod only 0.3 tons. These are spectacular differences and should convince almost anyone that cropping systems and cultural practices, as used by farmers, may exhaust or conserve the soils on sloping lands, depending on the systems followed. While the differences in runoff losses were not so spectacular as those of erosion losses, they were sufficient to show that under proper cropping and cultural systems much can be done in controlling the amount of water leaving a farm.

The results of these measurements of soil and water losses became available just at the beginning of the great upsurge of interest in soil and water conservation due largely to the efforts of Hugh Bennett, and they seem to have served a real purpose. This is an example of a simple investigation, developed somewhat accidentally, that provided much needed information at a time when important use could be made of it.

It may be of interest to those associated with soil conservation activities to know that the original plots laid out in 1917 are still under measurement. However, the plan has been completely revised and is now a study of the management of exposed subsoil as farming land. As a matter of fact, the 14 years of measurements resulted in such wide differences in the amount of soil remaining on the different plots that further measurements under the original plan seemed unwise.

The revised plan was inaugurated after the complete removal of the remainder of the original surface soil from all plots. It included systems of cropping and soil treatments which were thought best adapted to subsoil exposures. The idea was to determine what could be done in building up such lands and to measure the water and soil losses taking place.

The suggestion for this new plan came from some early work done by Dr. Duley at the same time these Missouri measurements were under way. He carried out an experiment on small strips of land from which the surface soil had been removed, as compared with land where the surface soil was still in place. The results of this experiment, running through a number of years, indicated that liberal amounts of lime and fertilizer applied to exposed subsoil brought approximately the same yields of small grain and mixed hay as were produced on the surface soil without treatment. It seemed important, therefore, that experiments be carried out on such eroded land to determine something of the response to treatments.

Missouri has thousands of acres of land that has lost all, or at least much, of its surface soil. The problem is what, if anything, can be done with such lands to bring them into economic production. Much depends, of course, on the nature of the subsoil and the degree of erosion. The tight claypan areas, which have been subject to much leaching, undoubtedly offer less opportunity for improvement than areas with subsoils which are more open and less leached, such as those of the glacial and loessial lands. However, I am of the opinion, that much can be done to bring back to economic production very large areas of the eroded soils of Missouri and other States.

It is undoubtedly of first importance to check the country's soil erosion losses, but it is also important to determine what can be done with those soils which are already badly eroded and which have possibilities of rehabilitation. I sometimes think that we should speak less of soil conservation and more of soil improvement. While it is of course true that soil conservation is the more popular and more appealing term, which doubtless should be retained as the official designation of the over-all soil-improvement activities, it must not be forgotten that mere conservation is quite insufficient for most agricultural lands. While some soil improvement accompanies most conservation measures, the future welfare of agriculture demands the use of widespread and intensive soil-improvement practices. By far the larger part of the agricultural lands of the country show marked deterioration and most of these lands will respond economically to effective measures of soil improvement. One of the real problems is to find means of putting such soil improvement measures into use.

Check Your Pond With a Minnow Seine

By Verne E. Davison

A MINNOW seine used in July, August, or September will settle most of your arguments about fish in farm ponds with no more than a few minutes' effort.

When you request fish to stock a pond—even a new one—a minnow seine pulled through the water's edge will reveal the kinds of fish present. If there are any little bluegills or other sunfish—and there often are, when you least expect them—there will be more than 1,000 or 1,500 per acre which otherwise would be sought for stocking the pond. Many thousand hatchery fish are wasted annually by being placed in ponds already adequately stocked with either the right or wrong kinds of fish.

How do fish find their way into ponds? Most commonly they are there because people finding it hard to be patient until the fall deliveries of fish, "just put in a few but didn't know they would spawn so soon." Fish also get in ponds by natural means; floods and birds—but not "by bein' rained."

If you don't believe the little bluegills you placed in a pond last winter are spawning this summer, just use the minnow seine.

NOTE.—The author is chief, regional biology division, Soil Conservation Service, Spartanburg, S. C.

If you want to be sure your new bass have spawned so you can begin catching those of usable size, look with the minnow seine. Even though you catch no more than one or two bass of finger length you can be sure there are more than enough throughout the pond to replace all the "big ones" you can catch. Equally important, you can be certain that the bass will keep a correct balance between themselves and the bluegills.

If in May or June or July you find no fingerling bass, there is something seriously wrong and you would do well to obtain 100 bass per acre for fertilized waters or 25 to 30 per acre for unfertilized ponds. Once in balance, the bass will continue to regulate their own number and that of the bluegills, provided you keep out the water weeds.

If you think you can hurt the reproduction of bluegills by fishing them off their spawning beds at every opportunity, see for yourself with a minnow seine. You'll be surprised to find plenty of little bluegills in spite of the heaviest possible fishing of parent stock.

If you believe little fish need the protection of weeds, brush, and shallow water to escape largemouth bass, eliminate these protective features. Then let a seining of minnows prove to your satisfaction that more than enough little ones are surviving at all times.

If the basic food supply is seriously short for the number of pounds of fish present, the minnow seine will show this, too, by revealing the pres-

ence of few or no tiny bluegills. Were the pond in good condition, bluegills would be hatching continuously through July, August, and September. A shortage may be a result of (1) too few or no bass, (2) too many 1- to 3-ounce bluegills, or (3) a low supply of food caused by failure to renew fertilization.

If you believe muddy ponds are unsuccessful because the bluegills and bass can't spawn, the minnow seine will give you a surprise. You will also find that "livestock trampling over the spawning beds" do not prevent the rearing of little fish. Silt and muddy waters are objectionable, but spawning will continue to take place, nevertheless.

If you think bass or bluegills or any other kind of fish—alone—will be satisfactory in a pond, watch their failure to reproduce the third year when a minnow seine will prove there is no further reproduction.

Which measures to use in correction of a pond where fishing is poor usually can be determined by sampling with a minnow seine. The balances between bass and forage fish, forage fish and basic food supply, and the relative proportions of little fish to large ones become apparent in the July to September analysis of little fishes.

HE GROWS COTTON UNDER CONSERVATION

By Edgar Hodson

Benefitted by green manure and fertilizer, long staple cotton made better than a bale to the acre on the farm of W. F. Bell (right). Robert S. Whitaker, Soil Conservation Service technician, examines the fibre at close range.

NOTE.—The author is Arkansas state conservationist, Soil Conservation Service.

SPRING of the year 1908 saw young W. F. Bell working hard on his new farm 6 miles southwest of Des Arc in central Arkansas. He was determined to grow a good cotton crop on an old sedge grass field which had been cleared of timber back in slave days.

The 10-acre tract had been idle for a long time. "The sedge grass showed the fertility was low," says Bell. "I guess the former owners had cropped the field to cotton until it couldn't produce at a profit any longer. Then they let it lie idle. Don't suppose there ever was a soil-building crop on the 10 acres before I bought the place.

"I spent the spring of 1908 hauling barnyard manure to the field," Bell recalls. "I spread a lot of it before I planted my cotton. Fall came and we picked three light bales off the 10 acres. That was good, because it was the first production on the field for a long time.

"I still grow cotton on the same 10 acres. Thirty of the 38 years I've had this place the field's been in cotton. But now, instead of the third of a bale to the acre of 1908, I average better than a bale. I get better lint, too. This year my lint runs one and one-fourth inches. That extra length is worth money.

"The reason I get a bale of cotton where I once got a third of a bale, and the reason I get longer staple, is my soil-building program. I've been building up the soil more than 25 years.

"For the past several years, I've been farming in cooperation with the Des Arc Soil Conservation District. The Soil Conservation Service technicians who help the district tell me they think I've been doing a pretty good soil conservation job all along." Bell is a supervisor of the district.

"The sod-building practices I've been following are about the same ones the technicians are recommending. They're common-sense methods. I plant hairy vetch or oats every winter, using inoculant and fertilizer as needed. The cover crop protects against erosion and provides considerable grazing for my cattle. Usually I turn my vetch under for green manure in spring. I harvest my oats, of course.

"Soil-building on the cotton field was just one part of the conservation job. Working my farm under agreement with the district is helping to get the best production in the most economical way from every acre—not just from my cotton field.

"My conservation agreement calls for growing Bermuda grass and Korean lespedeza for grazing and hay. I believe the Bermuda will build up poor land about as fast as anything you can put on it," says Bell.

The lespedeza, a volunteer, has done well for Bell.

"A fellow hardly knows what this lespedeza is worth," Bell states. "Plow it under and plant a crop of cotton and it'll bring it right out before you know it."

Korean lespedeza on Bell's farm. It's second growth, following a cutting of hay in midsummer. The plant Bell holds gives an indication of the amount of winter forage which will be available for his cattle.

Bell says that in using a lespedeza-oats rotation on part of his land he finds the oats pay farming expenses and the lespedeza profits are clear money. This year on a 10-acre field Bell harvested 480 bushels of oats and then followed up on the same field with 13 tons of lespedeza hay. Before he started building soil on that field, Bell says he would have considered a 140–bushel oat crop exceptional.

Some of Bell's 506 acres need drainage. He and Nelson Crum, Soil Conservation Service technician, have been planning a ditch system to carry off the excess water which is keeping some portions of the place from producing at capacity.

Bell has built a farm pond in following his agreement with the Des Arc Soil Conservation District. Stocked with fish, he expects the pond to begin providing pan-size bass before long.

Conservation farming is helping Bell handle the 100-head of cattle he owns. A deferred and rotation grazing plan he has developed with the help of Soil Conservation Service technicians assigned to the district provides for livestock the maximum amount of green forage while allowing the legumes and grasses in pastures to grow at peak capacity.

This year Bell cut 200 tons of hay from his meadows. The hay is stacked away in his barn ready for use. "That'll be as much or more than I'll need before there's green grazing available in the spring," he says.

Usually Bell plants his cotton in 4-foot rows. He says he finds that if complete fertilizer of the sort he uses is put in under the cotton it makes less work with weeds. "Put the fertilizer out broadcast and it helps the weeds about as much as the cotton," he says, "but put it under the cotton and the cotton gets practically all the benefits."

Bell has never forgotten how spreading barnyard manure helped him make his first cotton crop on the farm. He's still spreading the manure. Now, instead of a shovel and a lot of back-breaking labor, Bell has a modern manure-spreader.

Soil building is the keynote of Bell's farming. "I could ruin all the production I have here in three years if I didn't keep putting something back in the land," he asserts.

Maybe he could ruin his production in 3 years, but a look at the profitable production and controlled erosion which conservation farming has brought Bell gives definite promise that he isn't going to start depleting his land.

Grow Peanuts But Keep the Soil

By B. H. Hendrickson

SPANISH peanuts were grown three successive years at the Southern Piedmont Conservation Experiment Station, Watkinsville, Ga. The land had a 7 percent slope. Complete fertilizers were used. Both peanuts and peanut hay were harvested. No crop residue was left on the land. Bad erosion soon ensued. Cotton was planted in 1945. It was fertilized similarly to cotton on an adjoining plot where the soil had been improved by two previous crops of Kobe lespedeza grown for seed. The soil and water losses, and the yields, from both cotton areas were measured.

Cotton grown after peanuts in 1945 lost nearly 4 times as much run-off water and 26 times as much soil, and it yielded less than half as much cotton, as that which was grown after lespedeza.

The station's 6-year measurements of soil losses indicate that good yields of cotton, small grain, and lespedeza can be produced economically in rotation on well-terraced Southern Piedmont cropland of average 7 percent slope. The rate of soil washing is so slow as to indicate that the topsoil to plow depth will last for hundreds of years. Thus far, the yields have been improving gradually.

With continuous row-cropping to cotton and corn, however, the topsoil will be washed away in some 30 to 40 years. With continuous Spanish peanuts, the soil will be lost at an incredible rate.

On terraced sandy land having a gentle 3 percent slope the erosion rate with continuous peanuts was, of course, much slower. After 3 successive peanut crops, yields fell off in 1945 to 1,353 pounds of nuts per acre. Peanuts fertilized similarly but grown in a 2-year rotation, following oats and vetch hay, and volunteer crotalaria, made 2,205 pounds of nuts per acre. During the year when peanuts were grown on the rotated plot, less than half as much water was lost, and less than one-fifth as much soil.

If the soil is not built up by the addition of organic matter, it is apparent that it will fall prey quickly to erosion under continuous row-cropping, regardless of slope. The steeper the slope, the faster the destruction. Good farm practice, therefore, demands the use of crop residues or the addition of organic matter otherwise, prior to the planting of row crops.

Curly Aspen Holds Soil

Curly aspen, a hybrid, combines the firm wood of the gray poplar with the figured but otherwise low-value wood of the white poplar. It is said to grow rapidly from New Hampshire to Kentucky, and is of special interest to soil conservationists because of the spreading, fibrous root systems which are so effective for holding soil in place. Difficult to distinguish from the comparatively worthless white poplar, the curly aspen is best grown from nursery stock or from root sprouts of the genuine hybrid. The wood is useful for veneers.

NOTE.—The author is project supervisor, Southern Piedmont Conservation Experiment Station, Soil Conservation Service, Watkinsville, Ga.

A NEW 16 mm. color-sound motion picture, "Know Your Land," dealing with the technical subject of land classification—but *not* a technical film—is now nearing completion. It will soon be available for general distribution.

Ethan A. Norton, principal soil scientist, served as technical adviser on the film. The story development, direction, and photography, were supplied by the information division, Soil Conservation Service.

The film undertakes to present these fundamental points:

1. Lands differ, like people.
2. Land can be classified according to capabilities.
3. When land has been classified, it can then be treated according to needs.

"Know Your Land" should be useful in stimulating farmer interest and in furthering an understanding of the subject of land capability classification. It is left to field technicians to follow through with an explanation of the local application. Technically accurate, this picture should appeal to farmers and their families, business and professional people, educators, bankers, and civic organizations. It is the first time that an attempt has been made to explain the fundamental principles of land classification in a motion picture.

Kudzu in Philippines

"It may interest you to know that we have an extensive plantation of kudzu in our Hacarin Dairy Farm and that we believe kudzu has a good future in soil conservation in this country," writes Vicente A. Araneta, vice president of Gregorio Araneta, Inc., writing to *Soil Conservation* Magazine from Manila. He notes that the corporation plans to establish an agricultural high school "in which livestock and soil conservation will be stressed."

Here being prepared is a scene from the forthcoming motion picture "Know Your Land," soon to be released by the Soil Conservation Service. The picture portrays the use capabilities of the eight land classes. It likens soils to people, as it punches home the theme that sick lands respond to skilled diagnoses and treatments.

REFERENCE LIST ☆☆

Compiled by William L. Robey, Printing & Distribution Unit

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[1] From the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Rodney B. Radford explains a scene in the forthcoming motion picture, "Know Your Land," to the two leading characters, the farmer, at left, and the doctor. Elsewhere in this issue the film is discussed in more detail.

U S GOVERNMENT PRINTING OFFICE: 1946